

WHAT IS CLAIMED IS:

1. An electrochemical etching system, comprising:
an etching bath for holding an n-type silicon substrate so that one surface of said silicon substrate
5 contacts with hydrofluoric acid;
an electrode positioned in said hydrofluoric acid;
a power source having a positive polarity and a negative polarity, said positive polarity being connected to said silicon substrate and said negative polarity being
10 connected to said electrode; and
an illumination unit having a light source for an illumination of the other surface of said silicon substrate, wherein light source illuminates said the other surface of said silicon substrate with an illumination of $10\text{mW}/\text{cm}^2$ or
15 more.

2. An electrochemical etching system in accordance with claim 1, wherein a ratio of a maximum illumination to a minimum illumination to said the other surface of the
20 silicon substrate is 1.69:1 or less.

3. An electrochemical etching system in accordance with claim 1 or 2, further comprises
a reference electrode positioned in said
25 hydrofluoric acid; and

a voltage meter electrically connected between said reference electrode and said silicon substrate, said voltage meter having an elevated impedance.

5 4. An electrochemical etching system in accordance with any one of claims 1 to 3, wherein said illumination unit has an illumination controller for controlling said illumination of said the other surface of said silicon substrate.

10

5. An electrochemical etching system in accordance with claim 4, wherein said illumination controller controls an amount of light emitted from said light source.

15

6. An electrochemical etching system in accordance with claim 4, wherein said illumination controller has a modulator, said modulator being connected between said light source and said silicon substrate for modulating said light emitted from said light source.

20

7. An electrochemical etching system in accordance with any one of claims 4 to 6, further comprises

a current detector for detecting an electric current applied from said power source to said silicon substrate; and

25

an electric circuit for controlling said amount of said light emitted from said light source based upon said electric current detected by said current detector.

5 8. An electrochemical etching system in accordance with any one of claims 1 to 7, further comprises a unit for retaining a stable quality of said hydrofluoric acid.

10 9. An electrochemical etching system in accordance with any one of claims 1 to 8, further comprises a metal plate positioned on said the other surface of said silicon substrate, said metal plate having a number of openings arranged regularly for transmitting light which has been emitted from said illumination unit toward said the other
15 surface of said silicon substrate.

20 10. An electrochemical etching system in accordance with claim 9, wherein said metal plate is made of electrically conductive material and mounted on said the other surface of said silicon substrate.

25 11. An electrochemical etching system in accordance with claim 10, wherein said metal plate is integrally formed on said the other surface of said substrate.

12. An electrochemical etching system in accordance with claim 10, wherein said metal plate is independently formed on said the other surface of said substrate.

5 13. An electrochemical etching system in accordance with any one of claims 9 to 12, wherein a part of said metal plate remaining between neighboring openings has a width which is equal to or less than a thickness of said silicon substrate.

10 14. An electrochemical etching method having the steps of making one surface of an n-type silicon substrate into contact with an electrolyte, illuminating the other surface of said silicon substrate, and controlling an
15 etching current by said illumination to form a pore or trench in said one surface of said silicon substrate, characterized in that

the method further comprises

illuminating said the other surface of said
20 silicon substrate with an illumination of $10\text{mW}/\text{cm}^2$ or more.

15. An electrochemical etching method, further comprises

arranging a metal plate on said the other surface
25 of said silicon substrate, said metal plate having a number

of openings arranged regularly; and

illuminating said the other surface of said n-type silicon through said openings.

5 16. An electrochemical etching method in accordance with claim 14, wherein a ratio of a maximum illumination to a minimum illumination to said the other surface of the silicon substrate is 1.69:1 or less.

10 17. An electrochemical etching method having the steps of making one surface of an n-type silicon substrate into contact with an electrolyte, illuminating the other surface of said silicon substrate, and controlling an etching current by said illumination to form pores or
15 trenches in said one surface of said silicon substrate, characterized in that

the method further comprises

a first step in which said the other surface of said silicon substrate is illuminated with a first
20 illumination of $10\text{mW}/\text{cm}^2$ or more to form said pores or trenches extending toward said the other surface of said silicon substrate; and

a second step in which, after said first step, said the other surface of said silicon substrate is
25 illuminated with another illumination higher than said

first illumination to extend said pores or trenches laterally to connect said pores or trenches to each other.

18. A product manufactured by said electrochemical
5 etching method in accordance with any one of said claims 14
to 16.

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25